ISSN 0704-3716

Canadian Translation of Fisheries and Aquatic Sciences

No. 5408

The scientific justification of management of whale populations in the International Whaling Commission

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Original title: De wetenschappelijke verantwoording van het beheer van walvispopulaties in de Internationale Walvisvaart-Commissie

In: Lutra, 30: 157-165, 1987

Original language: Dutch

Available from:
Canada Institute for Scientific and Technical Information
National Research Council
Ottawa, Ontario, Canada K1A 0S2

1988

14 typescript pages

90-01536/

SECRETARY OF STATE - **MULTILINGUAL SERVICES DIR.** - TRANSLATION BUREAU

LIBRARY IDENTIFICATION

Translated from: DUTCH into ENGLISH

Author(s): K. Lankester

Title in English: The scientific justification of management of whale populations in the Internat. Whaling Commission

Title in Dutch: De wetenschappelijke verantwoording van het beheer van walvispopulaties in de Internationale Walvisvaart-Commissie

Reference in Dutch: Lutra, vol. 30, 1987

Reference in English:

Publisher:

Place of Publication: The Netherlands

Date of Publication:

Page numbers in original: 157 - 165

Number of typed pages: 11

Requesting department: DFO

Branch or division: Scient. Pubs.

Person requesting: Gary Stenson

Date of request: 17 Aug 1988

Translation Bureau No.: 3416373

Translator: PHB

Date completed: 24 Aug '88

Translator's Remarks:

Department of the Secretary of State of Canada

GENERAL MULTILINGUAL SECTION - MULT. SERV. DIR. - TRANSL. OPS. BRANCH

TRANSLATION OF DOCUMENTATION

		Date: 24 Aug 1988	
Department:	DFO	Translation Request No:	3416373
Branch/Div.:	Scient. Pubs.	Language:	Dutch
City:	Ottawa	Translated by:	PHB

(From 'Lutra', vol. 30, 1987, pp. 157-165):

THE SCIENTIFIC JUSTIFICATION OF THE MANEGEMENT OF WHALE POPULATIONS IN THE INTERNATIONAL WHALING COMMISSION

by K. LANKESTER

History

The history of commercial whaling goes back to the 16th century. At that time the Basques began to look beyond the Gulf of Bisquay and to catch whales in the northwest part of the Atlantic ocean. The Netherlands too participated early in this very lucrative business. In the 16th and 17th centuries mainly Dutchmen annihilated the Greenland whale Balaena mysticetus L., 1758, in the eastern part of the Atlantic Ocean, by their whaling near Spitsbergen. The value of whale products was so great in those days that the investment for an expedition was already covered by catching only a few whales. The hunt was mostly very intensive and this led to decimating many whale populations.

Initially slow-swimming species were the target, the 'true' Balaenidae and the spermwhale Physeter macrocephalus L., 1758. Upon the arrival of steamships in the 2nd half of the 19th century, the faster finfishes could also be pursued. And when, early in our century, 'almost inexhaustible' whale populations were reported in the antarctic waters, it

was already forgotten how in the past the populations on the northern hemisphere had been poached away entirely by whaling. With great vigor the finfishes (Balaenopteridae) were exploited, first from landstations and later from factory ships as well, so that processing could be done entirely at sea, which was much more efficient. The blue finfish Balaenoptera musculus L. (1758), by far the biggest species at 25 - 30 meters, received most of the attention.

Soon not many blue finfishes were left and subsequently the somewhat smaller common finfish B. physalus L. (1758) became the target. During the fifties, near Antarctica alone some 25-30,000 common finfish were caught annually (fig. 1). When not many of those remained either, it was the nordic finfish's turn (B. borealis Lesson) (1828) and subsequently the dwarf finfish's (B. acutorostrata Lacepède), 1804.

As early as in the thirties it had become clear that a regulating agency was needed to manage whales, to keep exploitation in check. To that end the whaling countries founded a cooperation effort, which resulted in 1946 in the 'International Convention for the Regulation of Whaling', with as its executive arm the International Whaling Commission (IWC). This convention was to guarantee the protection of whale populations with a view toward regulated hunting, as is evident from the original text of its charter:'...to provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry'. In the course of the years, however, more and more non-whaling countries got involved in the IWC, and these had a much more protective attitude to whales. Also, many international bodies were admitted as observers. Ultimately this led to a moratorium, an interruption for now of commercial whaling. As of the 1985/86 season all commercial whaling is prohibited.

However, this interruption does not apply to Norway, Japan and the Soviet Union, which have raised an official objection at the IWC and on that basis are still alowed to continue whaling. These 3 countries did indeed continue whaling after the moratorium came into force. In the meantime the Soviet Union and Japan have promised to cease whaling as of 1988.

The moratorium does not mean, by a long stretch, that no more whaling will be done. There are a number of ways to get around the rules and still whale. First, of course is piracy, 'illegal' whaling. Although in practice it is fairly difficult to poach whales, in the near future increased market value of whale meat could increase ingenuity. Thus, recently suspicion has arisen that in the Philippines illegal commercial whaling has occurred for Bryde's finfish Balaenoptera edeni Anderson 1878.

Additionally there is whaling for 'scientific' purposes. Iceland, South Korea and Japan have submitted proposals for such catches to the IWC. There are biologists who maintain the idea that continuing the present research could improve management of the whale populations. There has, however, been sharp criticism that the methods applied fall short of contributing sufficiently to managing the whale populations. Further, the research is paid for out of the yield from the products, and this tends towards abuse of this form of whaling.

At the annual meeting of the IWC of 1987 a motion was passed setting strict requirements for research proposals for scientific catches. The result is that it must first be shown that the research can make a contribution to whale management before a member state issues a permit. That this is difficult is evident from the fact that the three research programs proposed were strongly criticised by the IWC. The countries

involved subsequently received recommendations from the IWC to abandon their intentions.

Besides the forms of whaling mentioned there is 'aboriginal whaling', non-commercial whaling by population groups for whom this hunt is a cultural tradition. For a number of peoples (i.a. Eskimos in Alaska and two small villages in Indonesia) this category, probably correctly, has been exempted from the commercial whaling stipulations, but for others it is also a way out to continue ordinary whaling under the guise of conserving culture. The existence of an exception on behalf of certain population groups is in principle a good thing, but attention is required re abuse of this category.

Have the objectives of the IWC now been attained? Were the whale populations in the past 40 years managed in such a way that it is a matter of 'proper conservation of whale stocks and thus make possible the orderly development of the whaling industry'?

2. Scientific basis of whale management

As the years passed, more attention was paid to managing whale populations on a scientific basis. Partly as a result of the greatly increased catches in the fifties (fig. 2), more and more restrictive measures were applied to find a way inbetween unrestricted whaling and total protection (see VAN BEEK, 1987).

In 1987 the 'new management procedure' (NMP) was accepted as a guide in determining the limits. In accordance with this procedure, quota are set depending on the present level of the population in regard to the level before exploitation was taking place: the relative population size (fig. 3). Stocks (populations considered closed as far as management and their own dynamics are concerned) are classified on the basis of the NMP.

There are 3 classes: the 'initial management stock' (IMS), the 'sustained management stock' (SMS) and the 'protection stock' (PS). For each class, guidelines apply in determining a whaling quotum. A 'protection stock' is entirely protected from regular commercial whaling.

Classification is done by the advisory organ of the IWC, the Scientific Committee. In this, two types of research are done re the management of whale populations: short-term and long-term research. The former involves setting quota, and the long-term work is more structural and aimed at the characteristics and reliability of the techniques and methods applied.

Of essential importance for proper operation of the 'new management procedure' are the suppositions in the theoretical models used for it. It is especially important to know: (a) the size of the population in regard to the situation before whaling started; (b) the net accretion of the population, i.e. the difference between the number of animals dying and the number of newborn ones per unit of time; (c) the population level at which this accretion is at a maximum ('maximum sustainable yield level', MSYL) and (d) the maximum number of animals that can be caught to reach this level without the population decreasing further ('maximum sustainable yield', MSY). It is interesting to look at what the (often arbitrary) suppositions are, necessary for applying the NMP.

(1) The 'carrying capacity' is constant. This is the theoretical maximum equilibrium level a population reaches in a constant environment. At this level, as many animals die as are born during the same time. What size the population is then depends on the environment, such as e.g. the number of predators and the food supply. It is a simplified depiction of the situation to state that the maximum capacity of the environment is

constant in time: there are always natural variations or changes. When one considers the 'carrying capacity' in the longer term, as happens with whales, the changes can be great. Thus, serious pollution of the environment or a decrease in the number of predators present can lead to a change in the 'carrying capacity'. With the current population theories, present development of the grey whale population (Eschrichtius robustus Lilljeborg, 1861) along the Californian and Mexican coasts cannot be explained (COOKE, 1986a; LANKESTER & BEDDINGTON, 1986) and this has led to suggestions in the direction of a new 'carrying capacity'.

(2) The population model being used in the IWC is a simple one with logistic growth, following PELLA & TOMLINSON (1969). This supposes that a population has the property of getting relatively more offspring as soon as it becomes smaller, through hunting e.g. This is the density-dependent reaction by a population. In practice it is impossible to know the extent of the population at which accretion is greatest (MSYL). Most biologists agree that this level for big mammals (and thus for whales) is probably higher than 50% of the maximum population size which would be reached without hunting. This 'immeasurable' MSYL has been set by the IWC, arbitrarily, at 60% of the maximum population for whales.

(3) For whales, the maximum yield itself (MSY) is also very hard to determine experimentally. In the fifties estimates were made of MSY = 10% of the initial population (i.e. the population before whaling started) per year, but gradually it turned out that this percentage was much too high: with this, the populations continued to decrease fast. In 1964 it was agreed to give the MSY an arbitrary value of 4% of the MSYL (CHAPMAN, 1976). Recently it has been raised that it is better for the management not to exclude that the MSY-value lies between 1 and 4% of MSYL (COOKE &

LANKESTER, 1987), and this was accepted by the Scientific Committee of the IWC as a new temporary measure (IWC, 1987), because it appears acceptable that the actual MSY-value lies somewhere within this range. The size of the MSY is a direct measure for the whaling limit and thus plays a very important part politically, in spite of the fact that the scientific basis is not that thorough.

(4) In the model by PELLA & TOMLINSON (1969) it is assumed that the density-dependent reaction starts as soon as hunting begins. But in cases where essential details for the model are not well known, e.g. the net accretion of the population or the area of distribution, processes such as migration and a non-homogeneous distribution of the population can greatly affect the results of the model.

(5) There are 3 kinds of observations involved in population estimates at the IWC: (a) marking and re-catching of marked animals, (b) 'catch per unit effort' (CPUE), i.e. the catch per unit of work/effort, and (c) direct observations ('sightings').
It turns out that the reliability of all of these data is very low, with marking especially. One supposition in the theoretical background of marking and counting is that a population is homogeneously distributed over the part of the ocean investigated, something which in reality is not so. If then the borderlines between the populations are not known either, one is not much ahead. Further, until recently no account was taken of a number of possible complications in such theories. Thus, it was only recently acknowledged by the IWC that marks can be lost or that marked whales can have a greater chance of dying. In addition, COOKE (1986b) has recently shown that, to actually observe a decrease in the population with this method, the numbers of animals marked and re-caught

have to be so large that this appears to be unworkable in practice. Until now, population estimates on the basis of marks have invariably been too high.

A new, promising form of marking and re-catching is the taking of samples for identification of DNA patterns. For this, very small skin samples are taken of live whales with a crossbow; no animals need to be shot for this. In addition, no marking losses can occur and animals can be 're-caught' several times.

CPUE is a form of data based on a number of conditions known to be incorrect but which greatly affect the results. In addition, CPUE data from whaling are so variable that they are unusable to make it possible to estimate a trend in the population size (DE LA MARE, 1984). The effect of the processing time of the whales caught on the relationship between population size and CPUE too is only since recently being acknowledged by the IWC.

Direct observations are still the most promising data. In addition to systematic counts on a large scale, the method of individual recognition as now being applied to the humpback Megaptera novaeangliae Borowski, 1781, the 'south-caper' Eubalaena australis Desmoulins, 1822 and the orca Orcinus orca (L., 1758), can lead to remarkable improvement of our knowledge concerning whale populations.

With the 'PELLA-TOMLINSON' population model a population can be simulated by means of the known catch figures. In spite of all limitations attached to this, some of which were enumerated here, this is still the most generally accepted scientific basis for the management of whale populations.

Only in the eighties were the properties of the mathematical models on which the 'new management procedure' is based first being looked at critically. There were so many weak spots in the methods used until then, that many earlier research results proved unreliable. It was demonstrated inter alia that the already almost established 'evidence' of the density-dependent changes in age at which the animals become sexually mature or in the relative number of pregnant females, were based on faulty interpretations of the data (MIZROCH & YORK, 1984; COOKE, 1985).

It has become clear that the objectives of the IWC, as mentioned in the introduction, have not even remotely been reached. For lack of usable data practically not a single whale population can be classified and with that all catch quota are in fact unreliable. And a moratorium is certainly not a 'good development of whaling'. The IWC has therefore decided to completely revise the NMP. Separate meetings are called to look at how it can be prevented that on the one hand a population is overexploited and on the other hand the yield is far below the level possible in principle; consequently, a new compromise must be sought between economic interests and nature protection ones.

An important aspect arising now is the distribution of whales. For most populations we have no idea of where the borders of their areas are. One way of avoiding this problem is to take the most extreme borders. If e.g. the dwarf finfish in the Atlantic Ocean would consist not of several populations but of one big one, it would have to be determined whether this can lead to differences in management measures. This can then be taken into account in the future management of the area.
It is also important to involve the great variability in observations in determining the quota. The unreliability of the data should lead to

application of a safety margin to a quotum. In this way meaningful scientific research is stimulated, for more and more reliable data can lead to improved population estimates and subsequently to setting a more justified catch quotum. It looks as if especially 'sighting' data could meet these requirements, provided the counts are done on a large scale.

DE LA MARE (1986) and SAKURAMOTO & TANAKA (1986) have introduced alternative management systems with retro-coupling, in which measures must be taken if the population begins to deviate from the objective aimed at before. DE LA MARE's simulation studies showed that extremely variable catch quota must be counted on for a period of at least 50 years before a more constant catch level becomes possible. Economically this is of course very unattractive. In addition, as much as possible observations must be made independently from catches, because the present relationship between the catch and the reliablity of data (CPUE data e.g.) is seen as precisely one of the causes of the failure of the NMP.

The coming years will have to show whether the alternative procedure meets a large number of stringent criteria. In 1990 the IWC will again look at what possibilities there are for commercial whaling in the near future. It looks as if whaling on a limited scale is possible, if it is accepted that previously set risks for the whales are not exceeded. How restricted the industry will be depends on the reliablity requirements, the recovery of the whale populations and the knowledge of the whale stocks.

There are probably insurmountable problems in gathering somewhat reliable data with regard to managing whale populations. With that, the question arises how the IWC in the near future can continue regulating the catches

if a good scientific solution continues to be lacking. Many member states are of the view that, as long as not enough is known about the state in which a population finds itself, this population must in principle remain protected until it can be shown that with a limited catch chances of disastrous consequences are slight. This is a reversal of the present procedure. Now it must first be convincingly shown that a certain catch presents a danger to the population before the latter is protected. Because for the time being it does not look as if pronouncements on whale stocks can be made with great certainty, this would mean that for the time being the whales must be protected from commercial whaling. The economic interests, however, are such that it is questionable whether the whaling countries will let things get that far. Only if politics within the IWC in the coming years can effect an agreement will it be possible to prevent a license for anybody wanting to exploit whales commercially.

Word of thanks

This article was published with the financial support of the Foundation for International Nature Protection (Van Tienhoven Foundation).

(See also English summary and bibliography in original).

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betrouwbare gegevens en een gedegen theoretische achtergrond een beleid moet voorstaan waarin rekening wordt gehouden met zowel de walvissen als de walvisvaart. Mede hiervan hangt het af hoe de walvisvaart zich in de komende decennia zal ontwikkelen.

SUMMARY

The scientific justification for the management of whale stocks in the International Whaling Commission

Since the season 1985/86, all commercial whaling is prohibited for an indefinite period of time. In the International Whaling Commission (IWC) major adjustments of the procedures for whale management are in progress. The present population assessments and data are unable to meet the management objectives as they were set out by the IWC in 1946. Revised management procedures are being developed, which incorporate long-term management objectives based on a feedback control mechanism. This will determine the future development of the whaling industry.

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